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ABSTRACT

This study explores the hypothesis that the auditory discrimination abilities of disadvantaged Negro children can be improved significantly through an appropriate auditory perception training program. (AG)

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An Evaluation of Auditory Perception Training and Supplemental Reading Instruction for Children with Auditory Perception Disorders-- a Two Year Follow-up

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The role of auditory discrimination in the development of children's language and reading skills has been examined from a variety of perspectives. Correlative studies have dealt with the relationship between auditory discrimination and reading achievement among both advantaged and disadvantaged children. Experimental studies have evaluated attempts to improve auditory discrimination ability through special training programs. Some investigators have attempted to evaluate results of such programs in terms of reading progress while others have directed their attention to developing suitable auditory perception skills of disadvantaged children.

Relationship Between Auditory Discrimination and Reading Achievement

Even without the weight of supporting experimental evidence, there is considerable face validity as to the importance of auditory discrimination in mastering reading skills. Reading authorities state that silent reading comprehension and phonic analysis depend upon the ability to comprehend spoken words and to discriminate similarities and differences between speech sounds (Durrell and Murphy, 1963; Dykstra, 1966; and MacGinitie, 1967). The results of correlational studies indicate that a positive relationship exists between auditory discrimination and reading achievement (Wepman, 1960, 1961; Monroe, 1932; and Bond, 1935). Thompson (1963), who acquired data on 105 children in first and second grades, concluded that auditory discrimination ability is highly prognostic

of reading success and recommended that children who perform poorly on auditory perception tests should be given special training. Also, Reynolds (1953), studied the relationships of specific reading abilities and auditory characteristics of fourth grade children. He concluded that word recognition ability and learning sound elements for corresponding phonograms may be predicted accurately by auditory perception measures. The fact that faulty auditory discrimination skills often accompany poor reading seems to be well established; however, conclusive evidence that it is a causal factor has not been obtained.

Auditory Discrimination and the Disadvantaged Efforts to reverse the trend of below average performance in academic areas exhibited by many disadvantaged children has led to an examination of psychological attributes which may underlie their learning disabilities. A number of these investigations have focused on auditory perception. Deutsch (1964) found significant relationships between auditory discrimination measures and reading achievement. She postulated that children living in noisy and less speech-directed environments do not develop auditory discrimination skills requisite to reading, and that these and other environmental circumstances foster the development of learned inattention. Katz and Deutsch (1963) reported that lower socioeconomic status (SES) Negro elementary school children who were retarded readers learned more slowly and had greater difficulty with auditory stimuli than they did with visual stimuli. Clark and Richards (1966), working with preschool children ranging in age from 44 to 70 months, found that disadvantaged children were signi-

ficantly deficient in auditory discrimination ability when compared to nondisadvantaged children. Oakland (1969a, 1969b) examined relationships between SES and performance on phonemic and nonphonemic auditory discrimination tests. On the Auditory Discrimination Test (Wepman, 1958), the upper-middle SES group and the upper-lower SES group performed significantly better than the lower-lower SES group. On the nonphonemic auditory discrimination tests, the upper-middle SES group performed significantly better than did the upper-lower or lower-lower SES groups on seven of twelve measures. On no measures was a lower SES group significantly better than the higher SES group. In summary, evidence currently available suggests a difference in the auditory discrimination skills of disadvantaged and nondisadvantaged children.

Attempts to Improve Auditory Discrimination Skills Attempts to improve auditory discrimination skills through developmental or remedial programs have employed a variety of approaches. Almost all programs have used preschool or primary grade children as subjects; some have attempted to assess the effects of their training program through the use of auditory perception measures while others have broadened their evaluation to include reading achievement.

Two studies conducted with kindergarten children attempted to evaluate the effects of training programs in increasing auditory discrimination skills. In the McNeil and Stone study (1965) experimental children were trained to discriminate separate sounds in familiar words. The experimental groups performed significantly better than the control group on tests of nonsense and familiar

words. Silvaroli and Wheelock (1966) employed two experimental groups: one received training in discriminating phonemes in familiar words while the other received training in discriminating phonemes in nonsense words. A control group received no training. No differences were detected between the two experimental groups, but they both performed significantly better than the control group on the Auditory Discrimination Test.

Some investigations have been directed toward measuring the effect of auditory discrimination training on beginning reading achievement. Linehan (1958) reported an experimental study of factors related to beginning reading. As part of a training program, the names of letters and the ability to identify sounds in spoken words were taught early in the year. Mid-year results indicated significant superiority of the experimental group on tests of letter knowledge and distinguishing phonemes. At the end of the year the experimental group was superior in both oral and silent reading to a control group. In another study, Marmon (1967) provided supplementary training either in auditory discrimination, in alphabet recognition, or in a combined program of auditory discrimination and alphabet recognition. The Ss, lower SES Negro children and middle SES Caucasian children, all received reading instruction in the same basal reading program. Results from posttest measures of word recognition indicated that the combined program was the most effective for both Negro and Caucasian children. In comparing training in letter recognition with training in auditory discrimination, the former was found

to be more effective for Negro children. No differences between the two types of training were noted for the Caucasian children.

Feldman, Schmidt, and Deutsch (1966), in a study of the effects of an auditory training program on disadvantaged third grade retarded readers, reported no over-all superiority for any of their three treatment groups (reading, auditory, reading and auditory in separate sessions). However, a supplementary program--in which reading and auditory training were combined in the same lesson--yielded more favorable but still statistically insignificant results.

In general, while auditory discrimination training programs may yield increases in that ability, an accompanying increase in reading achievement is not demonstrated consistently.

There is considerable evidence to indicate that children from low SES groups often are deficient in auditory discrimination abilities (Deutsch, 1964; Katz and Deutsch, 1963; Clark and Richards, 1966; and Oakland, 1969a,b). Some studies demonstrate that auditory discrimination may be improved through training programs (e.g., Linehan, 1958; McNeil and Stone, 1965; Silveroli and Wheelock, 1966). This study explores the hypothesis that the auditory discrimination abilities of disadvantaged first grade Negro children can be improved significantly through an appropriate auditory perception training program.

Previous studies which attempted to improve auditory discrimination abilities have not consistently demonstrated a corresponding increase in reading achievement (e.g., Feldman,

Schmidt and Deutsch, 1966). The present study also is designed to examine the hypothesis that a program designed to facilitate the development of auditory perception abilities will have a corresponding impact on reading achievement.

Correlational studies indicate that many disabled readers perform poorly on tests of auditory discrimination (Bond, 1935; Wepman, 1960; Monroe, 1932; and Thompson, 1963). Therefore, it could be reasonably postulated that the acquisition of phonics skills is slow and difficult for children who have difficulty discriminating between speech sounds in spoken words. This study explores the third hypothesis that first grade Negro children with auditory discrimination disabilities profit more from a supplementary reading program which is directed away from their disability (by using a visual-linguistic method) than from one which is highly dependent on auditory skills (phonics).

METHOD

All first-grade children (N=190) in one predominantly Negro elementary school were eligible for this study provided that they (1) entered first grade for the first time, (2) passed at least eight of the ten items on the Pictorial Similarities and Differences II subtest of the Revised Stanford-Binet Scale (thereby indicating knowledge of the concepts same and different as required for the assessment of auditory discrimination ability), and (3) demonstrated adequate auditory acuity as measured by the Pure Tone Threshold Acuity Test using the Beltone Audiometer.

Two tests of phonemic auditory discrimination were administered to children who met the above criteria: the Auditory Discrimination Test (Wepman, 1958) and the Beginning Sounds and Ending Sounds Language Perception subtests of the SRA Achievement Series Reading 1-2 (Thorpe, Lefever, and Nasland, 1963). While the Auditory Discrimination Test was employed as a gross measure of auditory discrimination ability, the SRA subtests were used to acquire a more comprehensive assessment of auditory discrimination skills. Although the auditory training program was designed to develop a variety of auditory perception abilities, the auditory perception tests used as dependent variables measured growth only in phonemic discrimination. In addition, three posttests of reading achievement were administered at the end of the experimental phase of the study in the Spring, 1969: the Metropolitan Achievement Tests (Durost, 1959), the Gilmore Oral Reading Test (Gilmore and Gilmore, 1952) and an Eight-Point Reading Scale (which permitted the teacher to specify the children's independent reading level in basal readers). The Metropolitan Achievement Test also was administered in the Fall, 1969; Spring, 1970; Fall, 1970; and Spring, 1971 so as to measure more completely reading achievement during the primary grades.

Prior to the administration of the pretest battery, a decision was made to select children for the study who demonstrated the most severe auditory discrimination disabilities as indicated by performance on the Auditory Discrimination Test. Another decision was made to select eight children for each of the four experimental

groups as this is a realistic number of children to include in small instructional groups.

Sixty-four children who demonstrated the greatest auditory discrimination disabilities were identified. Eight children were selected randomly for each of the four experimental groups; the remaining thirty-two children comprised the control group. There were no significant differences between Ss in the four experimental and control groups on chronological age, pretest measures of auditory perception, or on the following measures of academic aptitude: Metropolitan Readiness Test (Hildreth, Griffiths, and McGauvran, 1964) and the Columbia Mental Maturity Scale (Burgemeister, Blum, and Lorge, 1954).

All experimental groups met daily for a forty-five minute period from October to May. The instruction received during this period was supplemental to the reading instruction which all children received in their regular classrooms.* Undergraduate and graduate students enrolled in reading methods courses served as teachers. Teacher assignments to groups were rotated systematically to control for a possible teacher effect. Instruction was supervised by staff and faculty from the Learning Disabilities Center at The University of Texas.

Different instructional methods were used with each of the four experimental groups. E_1 received supplementary reading

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*The Scott, Foresman series was used in the regular classroom.

instruction by a phonics method (e.g., Phonetic Keys to Reading) and auditory perception activities. E_2 received supplementary reading instruction by a visual-linguistic method (e.g., SRA Basic Reading Series) and auditory perception activities. E_3 received only supplementary reading instruction by the phonics method. E_4 received only supplementary reading instruction by the visual-linguistic method.

For purposes of this study, phonics is defined as a method of teaching reading in which pupils are instructed in assigning the correct speech sound to a grapheme.

The SRA Basic Reading Series is a modified linguistic method of teaching reading in which names and shapes of the letters of the alphabet are taught before whole words are learned. While some words are introduced strictly as sight vocabulary, the majority of the words are presented in spelling patterns; children are expected to discover generalizations governing the patterns. Letters and word parts are not isolated and associated with speech sounds; sounding and blending are discouraged. For purposes of this study, this method will be referred to as visual-linguistic. While all instructional methods make demands upon the beginning reader in terms of auditory and visual perception, it is the authors' opinion that methods which emphasize phonic analysis require a finer degree of auditory discrimination ability than do the visual-linguistic methods.

Daily auditory perception activities were approximately fifteen minutes in length. Audio-tapes, records, workbooks, and filmstrips were used together with classroom activities designed

by the authors to create a unified program for auditory perception development. Primary emphasis was placed on developing auditory attention, memory, and discrimination skills as they apply to classroom activities. The following general objectives served as an outline to guide the developmental sequence of the activities*: (1) to learn that objects make sounds; (2) to learn to label objects which make sounds; (3) to learn to recognize sounds of unseen objects; (4) to learn to label familiar sounds; (5) to learn to recognize differences among familiar sounds; (6) to learn to associate pictures with sounds; (7) to learn to identify and discriminate between sounds which differ in intensity, frequency, pattern, and duration; (8) to learn to discriminate spoken words as entities and recognize accented words within a sentence; (9) to learn to anticipate and supply missing parts of spoken words; (10) to learn to discriminate the number of syllables in a spoken word and recognize accented syllables; (11) to learn to perceive and discriminate among specific letter sounds; (12) to learn to retain speech sound sequences; (13) to learn to blend speech sounds; and (14) to learn to discriminate the temporal order of sounds within words.

RESULTS

Through use of analysis of variance (Veldman, 1967) and Duncan's New Mutliple Range Test (Edwards, 1960), data were analyzed to test the three hypotheses which pertain to Negro first

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*Auditory Perception (Oakland and Williams, 1971) contains a more complete description of activities used to facilitate auditory perception development.

grade children with identified auditory discrimination disabilities: (1) auditory perception training facilitates the development of auditory discrimination abilities; (2) a program designed to facilitate the development of auditory perception abilities also will facilitate the development of reading abilities; and (3) a supplemental reading program which does not rely heavily upon auditory perception skills will more favorably effect reading achievement than a supplemental reading program which relies upon auditory perception skills.

Comparisons between Groups Receiving Auditory Perception Activities ($E_{1\&2}$) and Those Not Receiving Auditory Perception Activities ($E_{3\&4}$ and C) Collapsing Ss from groups E_1 and E_2 and Ss from groups E_3 and E_4 permits comparisons to be made regarding the effectiveness of the auditory perception training activities in advancing auditory discrimination skills and in facilitating reading achievement. Ss receiving the auditory perception activities (E_1 and E_2) were expected to make greater improvement in auditory skills and reading achievement than those not receiving the activities (E_3, E_4 and Controls).

[put Table 1 about here]

Differences among the three groups on the Auditory Discrimination Test were not significant (Table 1). However, statistically significant differences were noted on three of the six SRA subtest measures: beginning pairs which differ ($E_{1\&2} < \text{control} < E_{3\&4}$); beginning pairs which are the same ($E_{1\&2} = E_{3\&4} < \text{control}$); beginning pairs total score ($E_{1\&2} < E_{3\&4} = \text{control}$).

No significant differences were found between $E_{1\&2}$, $E_{3\&4}$, and control groups in reading achievement measured on five administrations of the Metropolitan Achievement Test: Spring, 1969; Fall, 1969; Spring, 1970; Fall, 1970; and Spring, 1971 (Table 2). Also, no significant differences occurred on the Gilmore Oral Reading Test ($\overline{X}$ = 94 and 93) or the Eight-Point Reading Scale ($\overline{X}$ = 5.9 and 5.1) for $E_{1\&2}$ and $E_{3\&4}$ respectively.

[put Table 2 about here]

Comparisons between Groups Receiving Phonics (P) Instruction (E_1 and E_3), Groups Receiving Visual-Linguistic (VL) Instruction (E_2 and E_4) and the Control Group In order to compare the effectiveness of the two methods of reading instruction, Ss again were combined for purposes of analyses. While group differences in reading achievement were not apparent at the end of the experimental phase (Spring, 1969), significant differences in reading achievement were apparent on follow-up measures. These differences tend to favor the VL group.

On the Fall, 1969 administration, VL > P = control on Word Knowledge and Total Score; VL = control > P on Reading. On the Spring, 1970 administration, significant differences were noted on Reading and Total Score: VL > P; VL = C; P = C.

On the Fall, 1970 administration, group differences were not statistically significant. On the Spring, 1970 administration, VL > P = C on Word Knowledge and Total Score. Trends (p between .11 and .06) favoring the VL group are apparent on approximately one-half of the variables for which significant differences were not noted.

DISCUSSION

One purpose of this study was to evaluate the effectiveness of auditory perception activities in producing measurable changes in the auditory discrimination ability of first grade disadvantaged children. While there is a general tendency for Ss receiving the perceptual activities on most dependent measures of auditory discrimination, statistically significant differences were confined to three SRA subtests: beginning pairs (different), (same), and (total). The measurable effects of the perceptual training activites are apparent most directly on tests which assess a fairly circumscribed aspect of auditory discrimination (e.g., discrimination of beginning phonemes). Therefore, the first hypothesis was only partially confirmed.

Although there is no reason to negate the significant differences which partially confirm the hypothesis, there are identifiable reasons why the perceptual activities may not have had a greater impact.

The development of auditory perceptual abilities begins shortly after birth, continues through infancy and childhood, and tends to reach its asymtote toward early adolescence. Therefore, the auditory perceptual abilities of first grade children are undergoing development and refinement.

Evidence pertaining to the on-going development of one aspect of auditory perception--auditory discrimination--is available from the present study. During the first grade, children in the experimental groups who received only supplemental reading instruction

and children in the control group experienced gains of 11.2 and 10.0 on the Auditory Discrimination Test and gains of 2.7 and .5 on the SRA subtest measuring discrimination of ending sounds. This information, together with the data from the experimental groups which received the auditory perception program, indicates that children's auditory perception abilities improve during first grade and that the rate of improvement can be facilitated somewhat through training activities.

The auditory perception program was based on prior assumptions regarding the extent and nature of children's auditory disabilities. All activities were designed to be of benefit to the children. While there is some support for the program's efficacy with first-grade children, many of the initial activities appeared to be too elementary for them. The activities which were included in objectives one through seven now are judged by the authors to be more appropriate for early childhood and preschool programs while the activities in objectives eight through fourteen appear to be more appropriate for advancing the auditory skills of children in the first grade.

While children's auditory perceptual development is identifiable and measurable, the instruments and techniques available to measure auditory perception lack the accuracy needed for definitively specifying the stage of a child's auditory development. Because this more definitive information is not available, difficulties arise when remedial activities such as those used in the present study, are based upon a diagnostic-remedial model.

The principal difficulty educators face in working with children with learning disorders is to determine the nature of the remediation: exactly what needs improvement? Presently a number of educators and psychologists acknowledge the superiority of task analysis in facilitating the diagnostic-developmental (or remedial) process. Conceptually, task analysis encourages us to set our sights on a more well-defined and relevant set of objectives in an effort to more effectively guide instruction. With the benefit of hindsight, a task analysis approach may have led to the design of a more effective perceptual program in which activities would be directed toward advancing the specific auditory processes which are prerequisite to reading instruction within the Scott, Foresman series.

While there is some support for the hypothesis that an auditory perception program can facilitate the development of auditory perception abilities, there is no support for the hypothesis that a program designed to facilitate the development of auditory perception abilities will have a corresponding impact on reading achievement. No significant differences were apparent between Ss receiving the auditory perception activities and those not receiving the activities on the 22 measures of reading achievement. An accurate test of this second hypothesis is dependent on the full support of the first hypothesis. Because only partial support for the first hypothesis is available, an accurate test of the second hypothesis is limited.

The formation of a remedial program is based in part on a decision either to capitalize on children's strengths, to directly

work on remediating their specific disability, or to use a program combining both approaches. The hypothesis that children with auditory discrimination disabilities would profit more from a supplemental reading program directed away from their disability (by using a supplemental visual-linguistic reading method) rather than one which was more highly dependent on auditory skills (phonics) was partially confirmed.

While no measurable differences in reading achievement were noted at the end of first grade, measurable differences in favor of the VL groups were apparent at the beginning of second grade and irregularly thereafter.

That differences in reading achievement were not apparent at the end of first grade but were apparent in second grade deserves consideration. Initial word recognition instruction in the Scott, Foresman basal readers focuses upon acquisition of a sight vocabulary. Phonic word analysis is emphasized only after students have progressed through several books; for many disadvantaged children, this typically occurs in grade two. Therefore, for these disadvantaged children, the importance of speech sound discrimination abilities may not be emphasized until the second grade and thereafter. At this later time the achievement scores of children who have auditory discrimination disabilities or who lack a systematic alternative method of word analysis may reflect their handicap. Also, it is possible that while the children in this study did not assimilate and apply the special training and supplementary instruction during the experimental phase of the project, this assimilation and application occured later.

[put Figure 1 about here]

Figure 1 presents a graphic illustration of reading achievement for the five groups separately. Reading achievement is fairly linear for the four experimental groups. The relative distance between the VL and P groups increases markedly over the three years. Therefore, it appears that a supplemental reading program which provides other avenues to learning to read--and which relies less heavily upon auditory perception--provides children who have auditory problems a better opportunity to develop reading skills than does a program which re-emphasizes techniques which are taught in the classroom basal reading program.

An examination of trends among the four groups in reading achievement reveals a fairly consistent pattern: the group receiving auditory perception training and supplemental visual-linguistic reading instruction tends to read slightly better than the group receiving only visual-linguistic instruction; in turn, this group tends to read better than the group receiving auditory perception training and phonics instruction. The group receiving only phonic instruction read at a lower level than the other three groups. While these comparisons were not tested statistically, the data suggest that an effective remedial program should concentrate on remediating children's academic problems in reading by utilizing instructional techniques which do not rely heavily upon the children's disability while at the same time give some emphasis to the underlying perceptual disabilities.

The level of reading achievement for the two VL groups takes on added importance when their scores are compared to the average performance on the Spring 1971 administration of the Metropolitan Achievement Test of all third grade children at their school. The mean grade equivalent score on Total Reading for all third graders was approximately 3.3 compared to the mean of 3.8 for the two VL groups. Thus, the reading achievement scores for children with identified perceptual disabilities in auditory discrimination tended to be higher than the reading achievement scores for children the majority of whom had better perceptual abilities in auditory discrimination.

Table I

Error Scores on Tests of Auditory Discrimination

	$E_{1\&2}$		$E_{3\&4}$		Control		F	P
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD		
Auditory Discrimination Test								
Different Phonemes	10.2	4.0	13.0	6.2	12.0	4.1	1.2	.30
Same Phonemes	1.2	2.0	.4	.5	.8	1.1	1.6	.20
Total Score	11.5	4.0	13.4	6.1	12.9	4.6	.6	.56
SRA Language Perception								
Beginning Pairs: Different	4.4	2.0	9.0	3.5	6.7	3.9	6.5	.003 $E_{1\&2}<C<E_{3\&4}$
Beginning Pairs: Same	2.7	2.6	2.9	2.8	5.2	2.7	5.6	.006 $E_{1\&2}=E_{3\&4}<C$
Beginning Pairs: Total	7.1	2.8	12.0	2.9	12.0	3.6	10.7	.0003 $E_{1\&2}<E_{3\&4}=C$
Ending Pairs: Different	5.3	2.8	9.0	5.3	7.0	4.9	2.4	.10
Ending Pairs: Same	2.3	2.3	1.8	1.4	2.5	1.3	1.1	.34
Ending Pairs: Total	7.6	2.9	10.7	4.7	9.5	4.0	2.5	.12
N	16		15		31			

Table 2

Grade Equivalent Scores on the Metropolitan Achievement Test: Reading Achievement

	$E_{1\&2}$ $\bar{X}$	$E_{3\&4}$ $\bar{X}$	Control $\bar{X}$	F	P
Spring 1969					
Word Knowledge	1.9	1.9	1.7	2.4	.10
Word Discrimination	1.9	1.8	1.7	1.3	.29
Reading	1.9	1.8	1.7	1.1	.33
Total	1.9	1.8	1.7	1.7	.20
N	16	15	31		
Fall 1969					
Word Knowledge	1.9	1.9	1.8	.7	.50
Word Discrimination	2.1	1.9	2.0	.5	.63
Reading	2.0	1.8	1.9	.4	.67
Total	2.0	1.9	1.9	.6	.54
N	16	12	20		
Spring 1970					
Word Knowledge	2.8	2.6	2.7	.6	.56
Word Discrimination	3.0	2.8	3.0	.7	.53
Reading	2.9	2.7	2.7	.5	.63
Total	2.9	2.7	2.8	.7	.51
N	15	11	20		
Fall 1970					
Word Knowledge	2.9	2.7	2.8	.3	.79
Word Discrimination	3.3	3.0	3.2	.5	.64
Reading	2.7	2.5	2.7	.3	.73
Total	3.0	2.7	2.9	.3	.77
N	14	9	21		
Spring 1971					
Word Knowledge	3.5	3.2	3.1	1.2	.31
Word Discrimination	3.9	4.0	3.8	.1	.87
Reading	3.5	3.2	3.4	.4	.70
Total	3.6	3.5	3.4	.3	.75
N	13	9	18		

Table 2 (continued)

Grade Equivalent Scores on the Metropolitan Achievement Test:
Reading Achievement

	$E_{1\&3}$ $\bar{X}$	$E_{2\&4}$ $\bar{X}$	Control $\bar{X}$	F	P	
Spring 1969						
Word Knowledge	1.9	1.9	1.7	2.0	.14	
Word Discrimination	1.8	1.9	1.7	1.0	.61	
Reading	1.9	1.9	1.7	.6	.53	
Total	1.9	1.9	1.7	1.	.31	
N	15	16	31	1.2		
Fall 1969						
Word Knowledge	1.7	2.1	1.8	6.7	.003	$E_{2\&4} > E_{1\&3} = C$
Word Discrimination	1.8	2.2	2.0	2.9	.06	
Reading	1.6	2.1	1.9	4.2	.02	$E_{2\&4} = C > E_{1\&3}$
Total	1.7	2.2	1.9	5.7	.006	$E_{2\&4} > E_{1\&3} = C$
N	14	14	20			
Spring 1970						
Word Knowledge	2.5	2.8	2.7	1.8	.18	
Word Discrimination	2.6	3.2	3.0	3.0	.06	
Reading	2.5	3.1	2.7	3.2	.05	$E_{2\&4} > E_{1\&3}; E_{1\&3} = C; E_{2\&4} = C$
Total	2.5	3.0	2.8	4.0	.03	$E_{2\&4} > E_{1\&3}; E_{1\&3} = C; E_{2\&4} = C$
N	12	14	20			
Fall 1970						
Word Knowledge	2.4	3.2	2.8	2.5	.10	
Word Discrimination	2.8	3.5	3.2	2.3	.11	
Reading	2.3	2.9	2.7	1.9	.16	
Total	2.5	3.2	2.9	2.9	.06	
N	10	13	21			
Spring 1971						
Word Knowledge	2.9	3.8	3.1	6.2	.005	$E_{2\&4} > E_{1\&3} = C$
Word Discrimination	3.7	4.2	3.8	1.4	.26	
Reading	3.1	3.7	3.4	1.4	.25	
Total	3.2	3.9	3.4	3.1	.05	$E_{2\&4} > E_{1\&3} = C$
N	10	12	18			

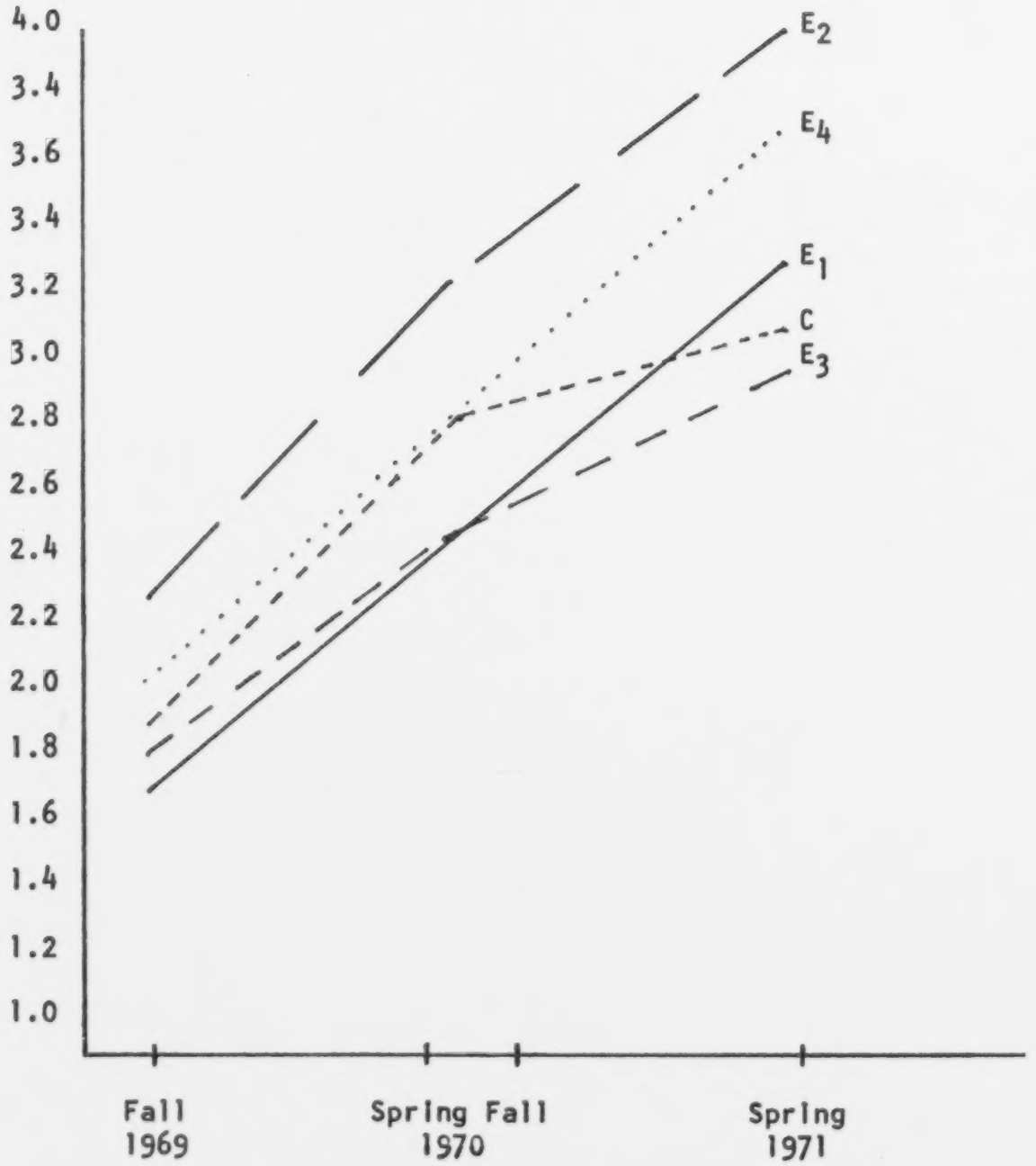

Figure 1.
Grade Equivalent Scores in Reading

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